Renewable and Sustainable Energy Reviews 39 (2014) 1012–1023

Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

Key criteria for sustainable wind energy planning—lessons from an institutional perspective on the impact assessment literature

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ARTICLE INFO

Article history:
Received 23 September 2013
Received in revised form
28 June 2014
Accepted 19 July 2014
Available online 9 August 2014

Keywords:
Renewable energy
Sustainability
Planning
Environment

ABSTRACT

An increasing number of researchers stress the importance of national planning institutions' role with respect to promoting an "effective" decision-making process in terms of bringing about sustainable energy. Impact assessment (IA) procedures are seen as having strong potential in supporting environmentally conscious energy production. This article discusses criteria for sustainable wind power planning and compares the centralised planning systems for wind energy in two countries – Norway and Scotland – as illustrating cases. We ask the following: What key criteria should be present to secure sustainable wind energy planning, and what are the critical institutional conditions to fulfil these criteria? A review of relevant IA literature reveals four key criteria for promoting sustainable wind planning: (i) clear and integrated political priorities, (ii) stakeholder involvement, (iii) strategic environmental assessment (SEA) and (iv) stringent permission and assessment requirements. We also determined that critical institutional conditions exist that effectively promote sustainable energy production: (a) coordinated energy policy institutions, (b) legitimate planning procedures, (c) that SEAs are followed in the decision-making process and (d) statutory planning regulations.

Contents

Abbreviations: (IA), Impact Assessment; (EIA), Environmental Impact Assessment; (SEA), Strategic Environmental Assessment; (SD), Sustainable Development; (ECDU), Energy Consents and Deployment Unit; (SNH), Scottish Natural Heritage; (SEPA), Scottish Environmental Protection Agency; (RSPB), Royal Society for Protection of Birds; (NVE), Norwegian Water Resource and Energy Directorate; (NEA),, Norwegian Environment Agency; (DCH), Directorate for Cultural Heritage; (TCA), Thematic Conflict Assessments; (EPI), Environmental Policy Integration

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http://dx.doi.org/10.1016/j.rser.2014.07.173
1364-0321/

1. Introduction

Although renewable energy generation, such as wind power, is widely regarded as an important contribution to the establishment of a sustainable low-carbon energy system, it is not entirely environmentally benign. Conflicts over concrete wind power projects often occur during the planning process and, in particular, are related to the local environmental impacts on the landscape and threats to wildlife. An increasing number of researchers stress the importance of the *planning institution's* role with respect to balancing the concern for renewable energy production and carbon reductions on the one hand and local environmental concerns on the other – bringing about sustainable energy projects [1–4]. The key regulatory mechanism used by a planning institution when considering the different concerns is impact assessments (IA). IA procedures are observed as playing an important role in supporting sustainable energy development. However, the planning process used in support of the development of environmentally acceptable energy projects is challenging. There is a call for a clearer definition of the criteria to be used in sustainable energy planning and to identify key institutional conditions required for IA regulations to effectively promote sustainable energy development in practice [1,4]. Based on a literature review of impact assessment procedures used during the energy planning process, this article asks the following:

1. *What key criteria should be present to "effectively" secure sustainable wind energy planning?*
2. *What factors represent the necessary planning institutional conditions required to fulfil the criteria?*

We argue that there are four particularly critical criteria for promoting the approval of sustainable and acceptable wind energy projects, which are dependent on institutional settings and mechanisms, such as coordinated and legitimate planning procedures and mandatory policies to be fulfilled:

- *Clear and integrated political priorities* from the central authorities
- *Stakeholder involvement* throughout the whole assessment and planning process
- *Strategic environmental assessment* (*SEA*) applied early in the planning process
- *Stringent* permission and assessment requirements

There has been an increasing tendency towards the centralised planning of large-scale wind developments, although this has proved to be challenging [5]. The wind planning performance of two countries with relatively centralised planning systems but different wind planning outcomes – Norway and Scotland – are applied as cases, illustrating how the key criteria for sustainable renewable energy planning work out in practice.

This article is organised as follows. Section 2 presents the theoretical framework, including a review of relevant IA literature and the development of key criteria for sustainable planning. Section 3 explains the methods and rationale for case selection, and data are presented. The ways in which the Norwegian and Scottish planning systems for wind energy perform are then described in Section 4, whereas theoretical implications for sustainable energy planning are discussed in Section 5. Finally, conclusions are presented in Section 6.

2. Theoretical framework

2.1. The challenge of balancing different values in sustainable renewable energy planning

Renewable energy generation is regarded as an important contribution in achieving a low-carbon energy system, reducing the dependence on fossil fuels and mitigating climate change. During the last decade, wind power has been the leading "new" (i.e., non-hydro) renewable technology – being the only one able to compete with conventional generation sources on economic grounds [6]. Welch and Venkateswaran [7] refer to the "dual sustainability" of wind energy, highlighting that wind energy is both environmentally benign and close to becoming financially self-sustaining. Another recent study by Yang et al. [8] concludes that wind power technology performs better than solar energy in terms of sustainability, without taking into account the environmental costs of wind farms' land occupation. Tabassum-Abbasi et al. [9], however, argue that with the trend of fast-increasing wind energy deployment, environmental concerns such as adverse impacts on wildlife are rising and likely to be much greater than reflected in most of the earlier research. In line with the latter study, we argue that providing environmentally acceptable development of any energy projects, including wind farms, is challenging. Conflicts related to both environmental and social impacts often occur in the wind planning process, which can influence the fate of specific wind power plants [10,11]. Community or individuals' attitudes towards wind farms are in particular strongly influenced by the visual impacts on the landscape and threats to wildlife [12,13]. One growing challenge relates to the cumulative impacts that may occur due to the decentralised and rapid development of wind farms over recent years. In countries such as Scotland, the most favourable locations for wind farm development are often upland areas valued for their scenic quality, which are frequently ecologically sensitive [14].

Moreover, while conflicts between development and conservation have traditionally revolved around how to balance socio-economic benefits with landscape, biological diversity, etc., the wind energy issue additionally sets opposing environmental goals. A central aspect of the debate called the "green on green" dispute represents the conflict between the need for climate change mitigation at a global level and local environmental conservation goals [15]. Such debates provoke fundamental dilemmas. For example, should the challenge of climate change force a reassessment of the priority given to protecting existing landscapes? Furthermore, at the heart of the debate are fundamental strategic dilemmas related to both *location* and the overall *scale* of wind energy in an area. For example, in total, how much wind energy should be deployed compared with other sustainable energy technologies and energy conservation? [5,16]. The debate does not just include objective "facts"; it also represents more complex

dilemmas involving clashes of genuine *values* and different goals and legitimate debates over what sort of sustainable future we want [5,14,15].

Although there is broad agreement that we need a transition towards a more *sustainable* energy system, a closer look at the concept of sustainable development (SD) reveals that the above-mentioned challenges connected to wind energy remain key dilemmas within the sustainability framework. The most famous definition states that SD should “ensure that it [the development] meets the needs of the present without compromising the ability of future generations to meet their own needs” [17]. Thus, SD refers to the fair distribution of resources and opportunities, both within nations and globally, in the *long run*. Regarding wind energy deployment, we have seen that it has the potential to contribute to mitigating dangerous climate change that might happen in the future. In contrast, extensive wind energy deployment in sensitive locations might limit the abilities of future generations by threatening the biological and ecological diversity fundamental to our prosperity. Therefore, a necessary condition for SD is that *limitations* “are imposed by the present state of technology and social organisation in environmental resources and by the ability of the biosphere to absorb the effects of human activities” [17]. Nevertheless, the need to *integrate* social, economic and environmental concerns is a key principle associated with SD [18]. In literature on the concept of SD, the *pre-cautionary principle* is also seen as a key concern, emphasising that the lack of scientific certainty on ecosystems' limits merits caution. Further, the *participation* of all concerned stakeholders in decision making is also a key principle [19], which is consistent with the emphasis on a fair distribution.

We see that within the elaboration of the concept of sustainability, there are potential tensions and trade-offs between key concerns within the wind energy debate, such as the need for (socio-economic) energy development, climate change mitigation and the protection of wildlife. Thus, both sides of the green-on-green debate draw on genuine arguments from a SD point of view.

2.2. Institutions as key premise providers of sustainability

Acknowledging the complexity of the energy planning situation, several researchers are currently focusing on the critical role of institutional settings in general and the *planning institution* in particular, facing the task of balancing the different values in wind energy development [5,12,15,20].

Political institutions are formally organised rules, practices and organisational structures that define the setting wherein policy making takes place [21]. The institutional perspective claims that political institutions matter, contributing to stability and change in political life. A central function of political rules is, for instance, that they create the possibility to coordinate many simultaneous activities in a way that make them mutually consistent [22]. With respect to achieving sustainable energy development, we have observed that economic development and environmental protection were regarded as mutually compatible concerns in the 1987 WCED report, pointing to the need for them to be integrated. Nevertheless, as emphasised by researchers within the “Environmental Policy Integration” (EPI) perspective, economic growth must not lead to ecological *degeneration* [23]. Rather, they indicate the need for a “de-coupling” of economic drivers from ecological degradation with continued economic growth in the form of a development that gives priority to environmental concerns (“re-coupling”). EPI implies that institutional mechanisms for the integration of environmental concerns in policy formulation and implementation are needed.

Although SD is widely accepted as a priority, it is still treated very much as a sectorial issue – a fragmented political handling of both socio-economic and environmental concerns is often the case [24,25]. Because earlier events or decisions have resulted in the establishment of “vested” practices and interests, it is commonplace to argue that political institutions are quite resistant to change – which often is necessary in cases where, for instance, environmental concerns are to be integrated with other concerns.

When coordinating different concerns in renewable energy planning, the key mechanism used by the planning institution is impact assessment (IA) policies and regulations. Applied optimally, IA procedures are observed as playing an important role in supporting policy integration and sustainable energy. IA procedures are explored in the following section.

2.3. Lessons from IA studies: criteria and conditions for promoting sustainable wind energy planning

Impact assessment (IA) is a generic term encompassing the different instruments and processes used in planning. Some of the most commonly used impact assessments are the Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) [19]. The aim of these methods is to ensure that development only proceeds in an acceptable manner [1]. Whereas EIA is the evaluation of effects likely to arise from a major *project* (or action) significantly affecting the environment, SEA refers to the systematic process of the analysis of environmental effects on policies, plans and programmes. Several authors argue that planning institutions could use IA measures in an “effective” manner by better integrating environmental considerations into the decision-making process [1,2,4,26]. Nevertheless, studies have shown that IA procedures often have a relatively weak impact on planning decisions – several critical challenges are pinpointed.

Based on a review of 24 studies, we have identified four main criteria for the “effective” use of impact assessments to promote sustainable energy planning, including key institutional conditions deemed critical for the fulfilment of the criteria. There are no clear-cut limits between the categories; moreover, some of the studies highlight the importance of more than one of the criteria. The following criteria form the main structure for the remainder of this review: (i) clear and integrated political priorities, (ii) stakeholder involvement (iii) SEA and (iv) stringent permission and assessment requirements.

2.3.1. Clear and integrated political priorities

Starting with the first category, the importance of *clear political priorities* is emphasised both in the impact assessment literature and in articles on sustainable wind energy planning. Firstly, researchers on sustainable wind energy planning, such as Agterbosch et al. [27], Wolsink [5] and Szarka [28], point to the fragmented goals within the authorities as a challenge for obtaining positive planning outcomes. The central planning institution usually has several objectives affected by wider political strategies and influences the concerns that are prioritised in the planning process. Wolsink stresses that countries with different conflicting political planning objectives jeopardise the attainment of their wind planning goals.

Further, Larsen et al. [25] see the lack of coordination between the different sectors and departments as the main reason why positive synergies are often missing between climate change and other environmental challenges (such as biological diversity) in IAs. Similarly, in their review article on the critical factors necessary for achieving the substantive effects of EIA, Zhang et al. [29] point to the importance of coordination between different institutions to harmonise the EIA process, avoid duplication of work and limit the need for bureaucratic intervention. Furthermore, Nykvist & Nilsson [24] and Jay et al. [1] agree that SD tends to be dependent on political will.

Nykvist & Nilsson found that for the Nordic countries, impact assessments only seemed to impact policy making when different ambitions coincided with other established strategic priorities grounded in the political landscape (such as cost efficiency). To allow impact assessments to integrate sustainability concerns, these authors suggest strengthening institutional arenas by giving them clear mandates and instructions. It is clear that a coordination of strategies between the relevant institutions and sectors is observed as an important institutional condition for the fulfilment of the first criteria, as indicated by both Nykvist and Nilsson [24] and Zhang et al. [29].

2.3.2. Stakeholder involvement

Secondly, the need for *stakeholder involvement* in planning is often raised by authors within the impact assessment perspective. Researchers within the IA literature criticise the dominant planning paradigm[1] for failing to take into account the cognitive limits of the planner, the collective nature of planning and the central role of dialogue [30]. The complexity and controversial nature of decision making requires a collaborative learning approach where different parties define the problems and generate alternative solutions [3,31].

Further, several researchers within the collaborative approach to IA emphasise that the conflicts related to wind planning are value laden and subjective, pointing to the potential for stakeholders to find mutually acceptable solutions though inclusive discourse and deliberation. Wilkins [32] highlights the potential advantages in involving different stakeholders, such as NGOs, to promote more sustainable solutions. According to Wilkins, inclusive stakeholder participation allows other perspectives to occur, rather than the typical focus on cost-benefit analysis that public authorities tend to prioritise; this inclusive approach can push social values towards a more long-term, sustainable focus.

However, Fischer [33] warns against “fully flexible” collaboration-led impact assessments, which is often associated with collaborative planning approaches and calls for open and fair debates. According to Fischer, one risks failing to provide the desired consensus because fragmented societies need some common pre-structured values. He stresses that collaboration should be firmly rooted in institutional structures and advocates that the planning process should follow pre-systematic conditions, such as underlying policies and plans. Furthermore, the potential for finding mutually acceptable solutions, alongside social and institutional learning, depends on the legitimacy and institutional settings of the process, for instance, pre-agreed rules for interaction and the extent to which different perspectives were considered in the process [31,33]. Having formalised pre-structured processes in place is also supported by institutional theory, suggesting that decisions are improved by formal rules [33].

2.3.3. SEA mechanisms

Thirdly, several of the studies in the review highlighted the need for applying *strategic environmental assessment*, i.e., SEA, in addition to project-level EIA. SEAs are aimed at formulating sustainable spatial and sector plans at higher levels of planning, such as at the regional or national scale. Several researchers point to the importance of the SEA as a key instrument for addressing the effects of multiple energy projects on the environment [1,33,34,35,36]. The limited space boundary for most EIAs precludes the consideration of other existing and planned projects, which, assessed together with the impacts of the project in question, could create greater pressure on the environment, making cumulative impacts a pressing issue [35,36]. Furthermore, by introducing a strategic overview analysis of environmental vulnerability before final project alternatives are designed in the EIA, the least acceptable or most sensitive areas could be eliminated from development at an early stage [34]. In addition, SEA could be a mechanism for reflexivity, by allowing critical questions on wider political strategies to be challenged in democratic and informed forums. Jay [2] stresses that the challenges we are now facing in the energy sector – such as the need for carbon reduction and other longer standing environmental concerns – should be built into an overall energy framework. Equally it could be debated on a strategic level; for example, nationally, how should the overall energy mix in a specific region or country look [2,6,16,37]? Further, the application of systematic pre-structured assessments could lead to a more efficient planning process and fewer conflicts at the decision-making level [33].

However, in practice, there have been challenges concerning the effective application of strategic spatial energy plans in the fragmented and often privatised energy sector. One is related to the difficulties of guiding commercially oriented industry actors to deploy wind energy in specific zones, to consider excluding other zones, as environmental and commercial concerns such as wind speed can often collide [16]. For the SEA to be an effective mechanism, it is critical that it is applied by the planning institution in the decision-making process, thus having an effect on the final planning outcome [26,34].

2.3.4. Stringent permission and assessment requirements

The fourth aspect regarding sustainable energy planning is *stringent* requirements for permission of developments and mitigation measures [1,4]. Firstly, impact assessments should result in the rejection of proposals having unacceptable impacts on the biological diversity and valuable landscape. Preferably, the elimination of poor projects should be undertaken at an early stage in the planning process, thereby avoiding unnecessarily large queues of projects requiring assessment and decisions within the planning system [38]. Secondly, an equally important focus in the literature has been the role IA can play in mitigating adverse impacts. The nature of a project's impact on wildlife is highly dependent on the project's design, including the size and micro-siting of the turbines [9,39]. Mandatory conditions and robust guidelines on mitigation issues have been shown to be critical to ensuring the effectiveness of impact assessments in avoiding adverse environmental impacts [1].

All in all, it is evident that the four main criteria identified in the IA and wind planning literature are largely complementary criteria for cautious environmental planning. Moreover, they largely correspond with the principles derived from the concept of SD. Firstly, political priority and the need for coordination are consistent with the integration principle that emphasises the need for reconciliation between (energy) production and environmental concerns. This includes “green on green” integration between the concerns for climate change mitigation and the protection of the biological diversity. Secondly, the use of stakeholder involvement criteria, related to having a more legitimate (i.e., participative) process and reaching mutually acceptable solutions, supports the participation principle that is a central concern from a sustainability perspective. And thirdly and fourthly, both strategic locational guidance and the need for strict conditions for permissions arguably harmonise with the intergenerational equity principle and the pre-cautionary principle. The central intention of both SEA and strict consent conditions is to avoid the adverse impacts of

[1] The “classical” planning perspective, rationalism, has traditionally portrayed planning as a logical and systematic process consisting of a problem, a need, goal objectives and criteria, the generation of alternatives and an explicit link to implementation [30].

deployment in the most sensitive areas. In a wind planning context, the criteria and how they could affect planning, related to critical institutional conditions, can be summarised as follows:

i. ***Clear and integrated energy political priorities*** promote positive planning outcomes and result in a less time-consuming planning process if (a) the relevant political institutions are coordinated.
   The way countries' renewable energy governmental documents and planning guidelines attempts to integrate the different concerns related to wind energy development is a relevant indicator.
ii. ***Stakeholder involvement*** promotes mutually acceptable solutions that are sustainable if (b) the planning process is based on legitimate planning guidelines.
   A relevant focus is how key stakeholders perceive their own role and influence on the planning process and the degree to which the process is observed as legitimate.
iii. ***SEA mechanisms*** promote steering deployment away from environmentally sensitive areas if (c) the SEA is applied by the planning institution in the decision-making process.
   The degree to which pre-structured strategic spatial plans are developed in a country is important, and it is critical that the SEA should have an effect on the planning outcomes.
iv. ***Stringent permission and assessment requirements*** promote environmentally benign planning outcomes if (d) they are backed by mandatory rules and guidelines.

Binding regulations on the impact assessment requirements in countries' planning laws and guidelines is important. The extent to which the regulations imply extensive assessments of the impacts on environmentally sensitive locations and limit development on conserved/designated land are critical factors.

To summarise, the likelihood of satisfying the four sustainable planning criteria increases substantially if the country's planning institution has the following conditions in place: (a) *coordinated* energy policy institutions, (b) a planning process perceived as *legitimate*, (c) that SEA is *applied* in the decision-making process and (d) *statutory* guidelines. In the following, we analyse Norway's and Scotland's wind-planning decision-making processes and the degree to which these countries' formal central-level planning systems harmonise with the key criteria. These case studies will be followed by a discussion on what lessons can be drawn from our examples regarding which critical institutional conditions need to be in place to fulfil the criteria. First, however, we present our data material and the rationale behind the case selection.

3. Method, data and case selection

In this study, a qualitative analysis has been conducted of academic literature, planning regulations and interviews, in addition to a quantitative overview of key wind planning statistics. Due to the explorative and evaluative character of the study, our main purpose has been to develop criteria for sustainable energy planning and propositions for further inquiries for the field.

Firstly, 24 earlier studies on sustainable energy planning in general and the application and impact assessment (IA) measures in particular were reviewed. The review provided the basis for the identification of four key criteria for sustainable wind energy planning and the critical institutional conditions allowing them to be fulfilled. To illustrate and discuss the criteria, a comparative analysis was conducted of the laws, regulations and planning guidelines and the application management statistics of the two case countries – Norway and Scotland. In addition, semi-structured interviews were undertaken with key stakeholders, including representatives from developers, central-level planning institutions, environmental NGOs and municipalities in both countries.

The central-level planning systems in Norway and Scotland are used as cases. By comparing a poorly performing country (Norway) with a country progressing quicker (Scotland) with regard to wind energy deployment, important differences in the decision-making process may be revealed, [5] and critical conditions for sustainable planning can be identified. In this regard, Norway and Scotland are relevant cases. Both countries generated almost no power from new renewables (such as wind energy) until 2000,[2] but over the last decade, they have experienced varying degrees of wind energy deployment [40]. In 2011, Norway produced 1.3 TWh of wind energy, whereas Scotland produced approximately 7 TWh [41].

The countries have significantly different conditions regarding their energy supply situation. *Norway* is one of the major producers of oil and gas; the country's gas exports accounted for approximately 20% of the European Union's gas consumption in 2010 [42]. Furthermore, in 2011, as much as 96% of Norway's electricity production originated from renewable sources, mainly hydropower, which made up 121 TWh [41]. Although *Scotland* is a major oil nation by European standards, it has passed its peak in both its oil and gas production. Scotland's hydropower production accounted for only 5.3 TWh and renewables made up 27% of their electricity production mix in 2011 [43].

Norway and Scotland are comparable cases because both operate within similar centralised planning systems when handling large wind power projects above 50 MW. Taking into consideration the differences in energy political contexts and outcomes, they represent interesting cases of energy planning strategies in a time of increasing sustainability demands.

4. Criteria for sustainable planning in Norway and Scotland

Basically, Norway's and Scotland's wind energy planning systems have important similarities with respect to managing applications for larger wind power plants. The planning systems for large wind energy application management is *centralised* in both countries. The central-level administrative Energy Consents and Deployment Unit (ECDU) in Scotland processes wind project applications above 50 MW, and the equivalent Norwegian Water resource and Energy Directorate (NVE) in Norway processes all wind project applications above 0.5 MW. Further, the countries' planning processes follow basically similar structures, as illustrated in Table 1. The process includes a pre-application phase where the developer conducts an EIA draft and the public is consulted. Submission of the application with a full EIA is followed by another public consultation, before a decision is made by the respective planning institution in Norway or Scotland.

However, there are some differences in the way applications are handled, which include the way appeals are treated and how and to what extent environmental sector authorities are involved in the planning process. In the Norwegian case, the application can be appealed *after* NVE has made its decision in the application stage. The final decision is made by the Norwegian Ministry of Petroleum and Energy. In the Scottish system, the application phase incorporates an eventual appeal in the application process in the form of a “public enquiry” *before* the Scottish Ministers make their decision, which is final.[3]

[2] Wind and bio power accounted for the modest amount of approximately 300–400 GWh in Norway and Scotland, respectively in 2000.

[3] In the case of an appeal, an independent reporter from the Directorate for Planning and Environmental Appeals (DPEA) considers all the planning evidence in the report, which is taken into account by the Scottish Ministers.

Table 1
Brief illustration of the consent decision-making systems for wind energy in Scotland and Norway—flows of action [47,48].

Central-level wind energy planning process in Norway and Scotland	
Norway	Scotland
Pre-application/ Scoping phase ***Developer* identifies location and discusses it with land owners, local council, affected authorities, etc.** ***Developer* undertakes *draft* EIA program** ***NVE* sends EIA program to the hearing, receives a Thematic Conflict Assessment conducted by sector authorities, incorporates the responses and sends to the Ministry of Environment for approval. Stakeholders have 6 weeks to comment** ***Developer* undertakes application and EIA**	**Pre-application/ Scoping phase** *Developer* identifies location and discusses it with land owners, local council, affected authorities, etc. *Developer* undertakes an EIA draft *ECDU* makes the draft EIA available to the public for comments and gives a "scoping opinion" on the EIA within 9 weeks, including the period for stakeholders to comment *Developer* prepares Environmental Statement Pre-application meeting between developer, ECDU and statutory consultees (recommended)
Application phase ***NVE* sends application and EIA to consultees and advertises in the press** **Stakeholders have 6 weeks to comment** ***NVE* evaluates responses (including TCAs from sectorial authorities) and makes a decision** **If needed:** **Further information is required from the NVE, with second consideration by stakeholders (at least 14 days)** ***NVE* assesses information and responses from the hearing**	**Application phase** *Developer* sends application and Environmental Statement to ECDU, advertises in the press and sends to the hearing Stakeholders have 28 days to comment (local planning authority have 4 weeks to comment) *ECDU* evaluates responses (over up to 4 weeks), and decides if further information is required After the initial response from statutory consultees the stakeholders have a further 28 days to make comments in light of the additional information. If needed: Further information is required from the ECDU, with second consideration by stakeholders (28 days) *ECDU* assesses new info. and responses from the hearing If required, due to significant impacts on an EU Natura 2000 site, "Appropriate assessment" is prepared by the *Scottish Ministers* If needed: *Scottish Ministers* can call for a public enquiry (equivalent to the Norwegian "appeal")
Decision phase [a] ***NVE's* decision**	**Decision phase** *ECDU* sends recommendation to the Scottish Ministers, on approval or rejection. *Scottish Ministers'* decision is final

[a] If needed: Appeal phase. *Min. of Petroleum* & *Energy* makes final decision

Further, the government's environmental advisors, called "statutory consultees" – the Scottish Natural Heritage (SNH) and Scottish Environmental Protection Agency (SEPA) – are given a more significant role than the equivalent organisation in Norway, the Norwegian Environment Agency (NEA, which until 1. June 2013 was called the Directorate for Nature Management). The NEA's role is primarily concerned with the protection of nature from harmful impacts, whereas the SNH and SEPA have a more explicit governmental mandate to promote renewables and climate change mitigation. In the 2013 Scottish "Good Practice Guidance" [44], it is stressed that effective engagement with the two environmental statutory consultees (from the pre-planning stage and throughout the whole process) is of vital importance for the success of planning applications.

In Norway, the NEA has a central function in the development of Thematic Conflict Assessments (TCAs) and assesses, together with the Directorate for Cultural Heritage (DCH), the impacts on biological diversity, landscape and cultural heritage. Projects are given an advisory score from A to E, representing no conflict (A) to adverse impacts (E). Projects receiving an E score mean that they imply a "massive conflict to national environmental goals". Whereas the impact of projects with a D score could be modified through extensive modifying measures, the environmental sector authorities state that the conflicts caused by projects with an E score cannot be reduced through modifying measures [45]. However, the TCAs, which have an advisory status, have had a limited impact on NVE's decision making. Out of a total of 25 projects that received a D score by the end of 2011, ten projects were approved, whereas only three were rejected. Out of the 12 projects that received an E score, four were approved, and three were rejected [46]. Similar to the TCAs, SNH's mapping of Scotland's territory into zones of "Natural Heritage Sensitivity" provides non-statutory advice. All the same, the SNH's advice could be argued to have a greater influence on the planning outcomes compared to the NEA's guidance, as is shown in more depth in Section 4.3.

Further, there are substantial differences in the planning *outcomes*, which makes it interesting to compare the countries, as shown in Table 2. Amongst others, the Scottish institution processes applications faster than the Norwegian institution and approves far more wind energy projects.

Taking into account the substantial differences in planning outcomes, Scotland appears to have a "successful" central-level planning regime in terms of promoting wind energy development.[4] In a sustainability context, however, we have seen that the need for new renewable energy development, which can promote climate change mitigation and socio-economic development, is only part of the concern. Another concern is the protection of valuable landscapes and biological diversity in the long term. Thus, the following is a relevant question: to what extent has the relatively high approval rates and lower application management time in Scotland been consistent with environmentally benign planning decisions?

[4] Progress in wind energy deployment, i.e. whether developers build the wind power schemes after being granted planning consent, is highly dependent on factors such as the level of subsidies in the respective countries, which is beyond the focus of this study.

Table 2
Onshore wind power capacity handled by the central planning authorities and average application management time between 2000 and 2013. Only projects > 50 MW are included.
Sources: [Norwegian statistics calculated from wind planning databases received from NVE. Scottish statistics adapted from ECDU's Branch Statistics received via information requests and from the UK Wind Energy Database; see [49]].

Overview of central-level wind planning decision making during 2000–2013		
	Norway	**Scotland**
Approved projects (MW)	2601	4976
Rejected projects (MW)	1561	1429
Approval rate [a]	62%	78 %
Operating wind capacity (MW)	448	2156
Deployment rate [b]	17%	43%
Average application management time [c]	4 years	3 years

[a] Per centage of wind power capacity applied for that is approved, compared to how much is rejected (*Approved/(Approved + Rejected) × 100%*).
[b] Per centage of how much of the approved wind energy capacity has been installed (*Operating Wind Capacity/Approved × 100%*).
[c] Average time it takes to approve projects between 2000 and 2013, from delivery of the application to final decision, including the time until appeals have been settled. The final decision must be inside this period; thus if a project has not yet been decided on, it is not included.

In the review, Section 2.3, we identified four criteria as being particularly relevant for sustainable planning: integrated energy political priorities, stakeholder involvement, SEA mechanisms and stringent permission and assessment requirements. Norway's and Scotland's performances on these four criteria are presented below.

4.1. Integrated energy objectives

In governmental papers on renewable energy written over the last few decades and in wind planning guidelines, different political objectives have been emphasised by Norway and Scotland.

Firstly, climate change has been a significant issue that has actualised political goals on wind energy deployment in both countries. In Norway, however, which until now has favoured more mature energy sources, such as hydro power, cost efficiency has been another important concern. In addition, other mitigation strategies, such as carbon capture and storage linked to natural gas, have been important. Differently, in Scotland, which has experienced a severe decline in oil and gas reserves and does not have similarly vast resources of hydro power, the government has prioritised wind energy related to energy security, 'green' economic growth and job possibilities [40].

Furthermore, in both of the countries' guidelines for wind planning, we find similar differences in the countries' approach towards wind energy. Starting with the governmental wind planning guidelines in *Norway*, wind energy deployment is seen as being relevant for mitigating climate change [47]. All the same, it is signalled that minimising the possible environmental and economic *costs* is the main goal:

"The goal on minimal environmental and social costs per kWh requires that wind power deployment in general should be concentrated, building larger constructions where one finds good wind resources, feasible infrastructure and where conflicts with other concerns are acceptable" [47]

The *Scottish* renewable energy planning guidelines emphasise the environmental and economic *benefits* of developing this industry in terms of achieving economic growth and securing sustainable energy deployment [50]. While highlighting the importance of making an effective response to the challenges of climate change, it is stated that support for renewables and the need to protect Scotland's environment must be regarded as "compatible goals":

"Support for renewable energy developments and the need to protect and enhance Scotland's natural and historic environment must be regarded as compatible goals (…)" [50]

Further, climate change commitments and economic growth are framed as twin goals:

"This commitment also recognises the ability to secure and diverse energy supplies and (…) support economic growth" [50]

Thus, the main difference between the two countries' approaches to wind energy deployment is the Norwegian emphasis on *cost* – both economic costs and environmental conflicts – versus more weight being placed on *benefits*, such as economic growth and compatibility between climate change and nature concerns, in the Scottish case. Thus, taking into account our first criteria for sustainable renewable energy planning, the Scottish renewable energy policy documents and planning guidelines regime appear to be more integrated and emphasise compatible objectives.

4.2. Stakeholder involvement

With respect to the possibility of *stakeholders* being involved in the planning process (cf. Table 1), it is evident that both systems allow stakeholders to have a say in significant stages of the EIA process. All the same, the ways the stakeholders perceive their own role and influence the planning process seem to differ significantly according to our interview data.

Scottish environmental stakeholders, namely the SNH, SEPA and Royal Society for the Protection of Birds (RSPB), described the planning process and the dialogue with developers and the Energy Consents and Deployment Unit (ECDU) as being largely constructive. They highlighted several examples of possibilities to match different concerns through "good practice". For instance, the UK's ornithological interest organisation in Scotland, the RSPB, pointed to the importance of meeting with the developer during the initial stages of the process, being able to select good projects early and saving on time and money. The promotion of early dialogue between all the different stakeholders is currently an important focus of the Scottish ECDU. The experience of the RSPB was that developers came to them initially to discuss which projects were likely to be too controversial and which were likely to be approved.

In contrast, the *Norwegian* stakeholders interviewed, including the Norwegian ornithological NGO, the Nature Conservation council, and representatives from the local council and developers, tended to distrust the planning process, referring to the process as an unpredictable "political game". Norwegian environmental NGOs, such as the bird interest organisation and the Nature Conservation council, regarded their role as being very limited. Further, in Section 4, we saw that the TCAs conducted by the NEA and DCH could not prevent projects observed as environmentally adverse from being rejected by the consents unit. Thus, the NEA did not believe that the TCAs worked as an effective measure in filtering out the environmentally least benign projects. Generally, the Norwegian environmental stakeholders believed environmental concerns had little weight in the decision-making process, pointing to other concerns such as cost efficiency, aviation and defence as being far more important. In comparison, the Scottish SNH's and RSPB's preferences regarding wind energy development were much more in line with the national policy, emphasising climate change mitigation, compared to that reported via the Norwegian experience. The RSPB emphasised the need for wind energy to prevent harmful climate change, whereas the Norwegian ornithological NGO characterised the link between wind

deployment in Norway and saving the climate as being "far-fetched".

However, a common point stressed by the environmental stakeholders in both Norway and Scotland was the need for a binding *national* location plan for wind to address cumulative environmental impacts. Although the SNH has a number of guidelines that developers are supposed to utilise, including, among others, a strategic locational guideline, a *binding* national wind location plan is seen as necessary to secure long-term environmental interests.

4.3. SEA mechanisms early on in the planning process

Regarding SEAs, which have the potential to steer wind development away from environmentally sensitive areas (at an early stage), both countries operate such plans. Scotland has both national and local strategic wind location plans, whereas Norway operates with strategic wind location plans at the regional level.

The *Norwegian* government urges the 19 regional counties to produce regional wind locational plans, representing a potentially interesting tool. By developing SEAs that identify preferred regional locations for wind energy development, the intention has been to identify sites that could allow concentrated wind developments that are both economically and environmentally feasible [47]. The plans are developed through democratic processes at the regional level, involving key stakeholders such as environmental NGOs and relevant local and regional councils [47].

However, the regional wind locational plans have been shown to have a limited effect on the choice of location for the development of wind farms. In Norway, Rogaland, one of the most important counties for wind energy development, a large number of planned and approved wind energy projects are located in locations regarded as "no-go" areas [interview with the NEA 2013]. Whilst environmental concerns were emphasised in the Rogaland plan, the lack of wind speed considerations and proximity to the grid – both critically important factors for the wind industry – have been highlighted as contributing to its lack of "effectiveness" on steering wind energy development [interview with developer 2013]. Furthermore, the Norwegian planning authority, NVE, has, until 2011, followed the locational guidelines in relevant regional plans in only approximately 50 per cent of their decisions [51]. By way of explanation, NVE points to the fact that the regional plans do not have mandatory status. Another challenge to the effectiveness of the Norwegian regional plans on wind power is the geographical gaps – several important wind energy regions have still not developed overarching locational plans for their wind development.

In *Scotland*, the government's conservation adviser, the SNH, has produced a strategic locational guidance [52] and has mapped the Scottish territory according to three zones of "Natural Heritage Sensitivity" – 'high, medium and low'. Similar to the Norwegian regional wind development plans and the NEA's and DCH's TCAs, the SNH's guidance is non-statutory. Regarding the planning outcomes of planned projects in the different zones, most of the wind development has occurred in medium sensitivity zones, closely followed by the lowest sensitivity areas. Still, approximately 20 per cent of the wind farms that have been proposed in "high sensitivity" zones, which include areas whose wildlife or landscapes are protected through national or international designations, have been approved or installed [53]. Furthermore, Scottish local councils are encouraged to identify broad areas in which wind farm projects above 20 MW would be supported. However, not all local councils have implemented such plans – thus, this strategic instrument has not worked as effectively as it was intended [interview with ECDU 2012].

While both planning systems apply SEA mechanisms aimed at promoting environmentally benign developments, the Scottish planning system would appear to have mechanisms with a clearer planning outcome when compared with the Norwegian regional plans – taking into account the fit between SNH's strategic locational guidance and the pattern of development. Nevertheless, we have observed that neither of the countries operated within a binding national wind locational plan, which was noted by all environmental stakeholders as being critical to preventing development in the most sensitive locations.

4.4. Stringent permission and assessment requirements

With respect to EIAs, the basic requirements share many similarities. As illustrated in Table 1, both planning systems require an EIA draft and a full EIA connected to the application. If required by the energy consent authority (ECDU/NVE), both planning systems also allow a second iteration of information gathering, in addition to the application and the related EIA. In both countries, requirements are set on how the IAs should be performed, including the content of EIA reports, hearings and procedures for publicity [54,55]. Similar concerns are listed in the countries' EIA regulations, including the requirement to describe the impact on fauna, flora, water, air, cultural heritage and landscape. Furthermore, the inter-relationship between these factors and cumulative impacts should be described. We have, however, observed that one formality related to the environmental sector authorities' role specific to the Norwegian procedure is that they undertake thematic conflict assessments (TCAs) as part of their response. TCAs could represent a stringent condition on permissions, but 33 per cent of projects with an E score are actually approved. Hence, the TCAs are only advisory.

Further, specific to the *Scottish* case, are the binding additional assessment requirements related to the EU Habitat Directive and the Birds Directive. Through these directives the EU commission can oblige Scottish Ministers to undertake an "appropriate assessment" if a proposed development is likely to have a significant effect on a European site, known as – Natura 2000 sites. The 393 Natura 2000 sites are designated in Scotland and account for approximately 15 per cent of the land surface [56]. Although Natura 2000 sites have a high level of protection, it does not mean that an "appropriate assessment" results in proposals always being turned down. The Government's and SNH's approaches are that the activities might be modified through the highest standard in siting and design so that they do not conflict with the special interests of the protected areas [cf. 52, interviews with ECDU and SNH 2012].

Norway has not implemented these EU directives but instead refers to international conventions that are not binding, such as Ramsar, Bonn and Bern, as well as the protection of red-list species and habitats. Nearly 17 per cent of Norwegian land area has some sort of formal conservation status [57]. The government's wind planning and locational guidelines do not offer very clear requirements for the assessment of protected areas, stating that conflict potential has to be considered on a case-by-case basis [38,47]. With the 2009 Nature Diversity Act came the central goal that Norway's conservation legislation should match the EU's nature protection level [58]. The law is applied in wind planning, bringing into focus the protection of habitats, ecosystems and species, as well as cumulative impacts. Further, the pre-cautionary principle is stated in law [59]. The paragraphs in the law are not mandatory but provide guidelines.

When making comparisons, it could be argued that the Scottish planning system harmonises the most with our key criteria for effective sustainable planning for several reasons. First, the Scottish renewable energy policy documents and planning guidelines appear more integrated, emphasising compatible objectives supporting wind power development. Second, the Scottish stakeholders felt more involved in the planning process and perceived

the planning regime to be more legitimate than their Norwegian counterparts. Furthermore, while both countries operated within stringent requirements for IA, only Scotland has binding international assessment requirements when specifically designated areas are affected. However, regarding the use of SEAs to avoid wind energy deployment in the most environmentally sensitive locations – it can be argued that neither country fulfils this criterion.

5. Discussion: coordination, legitimacy and statutory requirements critical for sustainable planning

We have argued that the Scottish planning system harmonises more with our key criteria for effective sustainable planning than the Norwegian activity. Further, in the theory section (Chapter 2), we assumed that for a country to fulfil the criteria, certain *institutional* conditions are critical. The two first criteria, (i) integrated political priorities and (ii) involvement of stakeholders, were assumed to be conditioned by *coordinated* energy institutions and *legitimate* planning procedures, respectively. Furthermore, the third and fourth criteria, (iii) SEA mechanisms and (iv) stringent permission and assessment requirements, were assumed to be dependent on SEAs being *applied* in the decision-making process and regulations being *statutory*, respectively. In the following sub-sections, we will discuss these institutional implications against our empirical findings, asking whether these institutional factors actually promote sustainable planning.

5.1. Coordinated and legitimate energy and planning institutions

We have argued the first criterion of integrated wind energy political objectives – which was present in Scotland – seems to be critical to attaining positive wind planning outcomes [5]. Scotland has a higher throughput of applications in the central-level planning system than Norway, and applications are handled within three quarters of the time. In the theory section, we assumed that a central institutional condition for the implementation of integrated political priorities is that the relevant energy political *institutions* and sectors are *coordinated* [23,24,29]. This condition could also be argued to characterise the political-administrative system for renewable energy planning in Scotland. With the Scottish environmental agencies' mandate to pursue the development of renewables, the Scottish planning institution seems to facilitate, or impose, greater coordination between the concerns for energy production and environmental protection, which evidently differs from the more fragmented Norwegian wind energy institutional landscape. Here, both current discussions on wind and hydro power development are characterised by confrontations between environmental and energy authorities [46,60]. Rudberg et al. [46] identified a similar pattern to the one we found in Scotland in the Swedish wind energy planning. Moreover, relevant Swedish administrative actors are given mandates to support the expansion of wind power. Furthermore, like Scotland, the Swedish government has not regarded wind energy objectives and environmental protection as conflicting. In addition, Sweden has experienced much faster progress in wind energy than Norway. Thus, institutional coordination between the relevant energy and environmental institutions appears to be a relevant condition for the promotion of positive planning outcomes for wind energy developments.

Regarding the second criterion, we have observed that the Scottish *environmental stakeholders* viewed their role and impact in the planning process as being more influential than the corresponding stakeholders in Norway. In line with what IA researchers such as Wilkins [32] point to, the involvement of environmental factors, such as the SHN and a central NGO such as the RSPB, seemed to facilitate acceptable planning solutions through deliberation. In Norway, practically every project is appealed. Thus, our institutional condition, allowing active stakeholder involvement, is supported; mutually acceptable planning solutions among stakeholders appear to be promoted when the process and planning policies are observed as *legitimate*. In Section 2.3.2, we observed that Fischer [33] emphasised the importance of stakeholder collaboration being firmly rooted in institutional structures and underlying policies to reach the desired mutually acceptable solutions. In this regard, the coordinated Scottish planning regime seems to generate more legitimate planning processes than the Norwegian approach.

Following the "Environmental Policy Integration" (EPI) perspective, however, it is clear that the economic drivers – which are more integrated in the Scottish wind energy political objectives – should not be coupled to ecological *degeneration* [23]. Together with the "green on green" dilemma between the focus on climate change mitigation and protecting biodiversity, economic growth versus environment is a relevant trade-off in renewable energy planning. Thus, sustainable planning requires institutional commitments and regulations that can prevent unrestricted growth to ensure that precautionary measures are taken. This leads us to the next two criteria on strategic guidance and stringent assessments to protect the interests of natural heritage.

5.2. Statutory regulations as necessary for pre-caution in planning

We have argued that as a result of decentralised and rapid development over the recent years, cumulative impacts and development in environmentally sensitive locations is a growing challenge to wind energy deployment [2,3,9]. *SEA mechanisms* that consider cumulative impacts in a systematic way are required and represent our third criteria for sustainable wind planning. Both the SNH's strategic locational guidance and the Norwegian regional plans are attempts to secure environmentally benign planning, guiding the development to less sensitive areas. We found that the most important strategic impact mechanisms in the Scottish planning system, the SNH's strategic locational guidance, seemed to have a clearer "filtering effect" on projects proposed in environmental sensitive sites than the Norwegian regional wind location plans. In the Norwegian case, a lack of consideration for concerns relating to wind speed and the proximity of the site to the existing grid was a serious flaw according to wind developers. This pattern fits well with Power and Cowell's [16] findings relating to the difficulties of steering the industry to deploy wind energy in specific zones because commercial and environmental concerns often collide.

We have argued that a critical institutional condition that would enable the SEA to be an effective tool is that the SEA is followed by the planning institution in the decision-making process; thereby having impacts on the planning outcomes. Neither of the strategic mechanisms can be argued to have worked optimally. Although the SHN's plan fits relatively well with the development pattern, 20 per cent of the projects being proposed in "high sensitivity" zones have been approved or installed. Further, the Norwegian regional plans were criticised for trying to steer the wind power developers into specific zones that lacked proper wind speeds. If strategic locational plans were developed more thoroughly in a process that included all the key stakeholders, more weight could have been put on these in the final decision making. Moreover, as we assumed in the review section, we will argue that a key institutional condition required for the SEA mechanism to work effectively is that it should be *followed* by the planning institution in the decision-making process.

Furthermore, we have argued that *a stringent requirement for IA procedures and the approval of applications* represent a fourth key criterion with respect to promoting environmentally benign wind energy development. In this setting, we observed that the countries' general IA requirements were largely similar. However, the Scottish planning regime had an additional *binding* assessment requirement for projects that affected European conservation areas. Although Norway has ratified agreements, such as the Ramsar, Bern and Bonn conventions, which are relevant for assessing wind energy development in designated areas, they are not binding. Furthermore, the advisory thematic conflict assessments (TCAs) carried out by the Norwegian environmental sector authorities have the potential to filter out the most negative projects, but the TCAs have proved to be unsuccessful in preventing approval of "no-projects". We have assumed that permission and assessment measures should be *statutory* to effectively minimise adverse impacts on valuable nature. It could be argued that this institutional factor is present in Scotland to a larger extent due to the strict assessment requirements as a consequence of being a member of the Natura 2000 network.

However, more research is required to determine whether particularly environmentally sensitive areas are better protected within the Scottish or Norwegian central planning regime. We observed that in Scotland, where "appropriate assessments" are required, similarly to the zones the SNH had marked as highly sensitive, wind deployment has been allowed several times, although much focus has been devoted to mitigating adverse impacts, among others, by the conscious and detailed location of wind turbines on the terrain. A critical question in this regards is whether wind development and ecologically sensitive areas can co-exist without having an adverse impact on biodiversity as a result. There is limited knowledge on the overall impact of wind development on wildlife relating to the most controversial impacts, such as bird and bat mortality [6,9]. To avoid adverse environmental impacts, more research on the "effectiveness" of mitigating measures in planning is required.

Although, all in all, it could be argued that Scotland harmonises more with key criteria for sustainable planning than Norway, time will show the extent to which such rapid development is environmentally benign and publicly acceptable in the long run. As Scotland's political environment has been dominated by concern to deliver on escalating renewable energy targets, wind planning researchers are addressing mechanisms that can limit development in sensitive locations [6,16]. Furthermore, we have seen that researchers within the EPI perspective emphasise the risk that economically motivated energy development can lead to ecological degeneration [23]. They stress that SD implies that environmental concerns must be a priority, referring to the need for institutional mechanisms that can secure this. In this respect, we will argue that a statutory *national* wind location plan is highly relevant from an SD perspective. In addition, having the possibility of directing wind energy installations away from the most conflicting and sensitive areas (in line with the precautionary principle) could be a means for democratic participation and reflection on an issue, having a prominent and potentially long-term impact on the landscape and ecosystems. Important topics in this debate include discussions on how much wind power is needed and what spatial limits should be set to ensure that biological and ecological diversity is not threatened. In this time of rapid and decentralised deployment of wind energy, it could be argued that there is an urgent need for a regulatory mechanism for sustainable wind planning [6].

5.3. The future sustainability of wind energy

Wind energy is expected to lead the shift from fossil fuels to a renewable energy system [9]. The aim of the Intergovernmental Panel on Climate Change is for 20 per cent of the world's electricity demand to be met by wind energy by 2050; at present, it represents only 1.8 per cent of the global electricity generation. The urgency to mitigate dangerous effects from *global warming* by replacing fossil fuel-based electricity production with renewables is indeed a key argument in favour of continuing the strong initiatives in many countries to enhance harvesting energy from wind.[5] Further, while a common criticism towards wind energy used to be that it represents a costly energy technology, it is currently regarded as largely *affordable* compared with conventional energy sources (with or without subsidies) [15].

Nevertheless, as the usage of continuously larger wind turbines has increased significantly in different parts of the world within the last decades, environmental concerns have increased. What is often called the *NIMBY* (Not In My Back Yard) syndrome has been a major dimension of conflict, although it has not been a central focus in this article [cf. 12,20]. While several studies on wind planning have portrayed local objections as a planning barrier, which could be explained by a lack of insight or selfishness, recent studies note that these are not necessarily valid counter-arguments. Factors such as visual effects and noise disturbance from turbines are genuine concerns that indeed can impact human health [9]. As we have pointed to in this review, wind energy deployment is not only about "facts" but also clashes of values and debates over what sort of sustainable future we want.

Furthermore, evidence is emerging that the impacts from wind energy deployment on the *wildlife* are likely to be far more adverse than reflected until recently; in particular this is the case for *birds and bats* [9,61]. A commonly used counter argument about the effects of wind farms on birds is the statement that the impact is minor; other factors such as hunters, vehicles and electricity transmission kill a much larger number of birds [62,63]. Although not false, the argument masks the reality that the threat posed by wind farms is not insignificant [9]. Further, data, such as the number of birds/bats killed per turbine, mask the effects on the specific species involved that might be very sensitive to an increase in mortality; for instance, some wind farms have affected local populations of raptors and seabirds. In addition, there is a great deal of uncertainty in our understanding of the impacts on birds, not least due to the lack of thorough, longer-term BACI (before-after-control-impact) assessments and models that can predict the effects on the whole population of species [9,64]. Thus, in line with our findings that assessment regulation should be binding to be efficient, Tabassum-Abassi et al. [9] argue that extensive BACI studies on avifauna should be made mandatory.

Finally, we will argue that wind energy has the potential to be an important part of a sustainable energy mix in many countries and is critical for phasing out fossil fuels. We have, however, warned against unrestricted deployment. The increasing awareness concerning environmental impacts evident in recent studies underscores the relevance of following key principles associated with the concept of SD. These are reflected in our four criteria for sustainable planning. Of particular relevance are the *pre-cautionary principle* and the need to impose constraints on deployment. Therefore, for a country's wind energy development, SEA is needed to achieve environmentally benign locations for new renewables with a reduction in overall energy use. Such strategic-level plans will benefit from enjoying the legitimacy derived from a fair and inclusive decision-making process and from being applied in the decision-making process; if plans and guidelines are not followed, IA procedures risk remaining an inefficient tool for sustainable planning.

[5] Yet, according to Tabassum-Abbasi et al. [9] an emerging concern is the impact that large wind farms may have on the weather, and possibly the climate. This illustrates some of the complexity associated with the issue.

6. Conclusions

In this paper, we identified key criteria for promoting the environmentally acceptable development of positive wind planning outcomes. Moreover, our focus has been on the central-level wind planning institution's potential to select sustainable wind projects. We have argued that four criteria are particularly critical: (i) the importance of integrated central-level energy political priorities, (ii) stakeholder involvement, (iii) SEA mechanisms, and (iv) stringent permission and assessment requirements. Norway and Scotland's formal central-level wind planning regimes have been analysed according to these four criteria.

We have found that the Scottish planning system harmonises more with our key criteria for effective sustainable planning than the Norwegian system. Scotland seems, to some extent, to have more integrated political priorities that promote wind energy deployment, biodiversity concerns and stakeholder involvement. The existence of (a) *coordinated energy political institutions* and (b) *legitimate* planning procedures seems to be key conditions for fulfilling these criteria. This pattern characterised Scotland, whereas the Norwegian renewable energy institutions reflected a more fragmented wind energy planning system. However, in Scotland, there is still some way to go before broader sustainability criteria are fulfilled.

The third criterion – the use of SEA to avoid wind energy deployment in the most environmentally sensitive locations – appears to have not been fulfilled by either country. We argue that the countries should have implemented SEA in the form of a binding strategic-level wind locational plan, allowing an overview analysis of environmental vulnerability before specific projects are designed. If overall plans are not followed, IA procedures risk remaining an inefficient tool for sustainable planning. As for the fourth criterion, both countries operated within stringent requirements for IA, but only Scotland had binding international assessment requirements when particularly sensitive areas are affected. Thus, for the third and fourth sustainable planning criteria, critical institutional conditions would appear to be as follows: (c) SEAs are *followed* up on by the planning institution in the decision-making process and (d) *statutory* regulations exist.

Thus, we argue that *coordinated institutions* are an important precondition for facilitating positive planning outcomes through integrated planning objectives and constructive stakeholder participation. Coordinated institutions, securing "green on green" integration, could deliver large-scale wind deployment within the constraints of other environmental concerns. However, we have argued that to do so to a full extent, the SEA must be followed, and *mandatory regulations* appear to be critical in securing environmentally cautious development in line with the pre-cautionary principle.

From this review, it can be concluded that wind energy has the potential to be an important part of the sustainable energy mix in many countries. However, this potential is dependent on deployment following overall strategic plans, which take into account the need to accompany the development of new renewable energy with a reduction in overall energy use. Further, following the great deal of uncertainty about environmental impacts, there is a strong need for longer term studies, which can predict the effects of both individual wind farms and clusters with cumulative effects on species across extensive areas.

Acknowledgements

The authors would like to thank Oluf Langhelle, Hilmar Rommetvedt, Bernt Blindheim and David Toke for their valuable comments and readings. We would also like to thank colleagues at the International Research Institute of Stavanger (IRIS), participants at the 21st Annual Norwegian National Political Science Conference in Bodø, Norway 2013 and participants at the Nordic Environmental Social Science Conference in Copenhagen, Denmark 2013 for their helpful comments. Finally, we are grateful to the anonymous reviewers who helped us improve the article.

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